Working Memo 432

DATE: 24 February 1984

TO: Division Staff

FROM: Thomas B. Gray, P.E., Assistant Technical Services Chief, Bureau of Water Supply Engineering

THRU: Allen R. Hammer, P.E., Director, Bureau of Water Supply Engineering

E.H. Bartsch, P.E., Director, Division of Water Programs

SUBJECT: WATER - PROCEDURE - SAMPLE COLLECTION/ANALYSIS

Delete Working Memoranda 337, (indexed in 1982 Table of Contents as memo III-B-3-b), 370, 374, and 418

This memorandum will consolidate and supersede all other memoranda on this topic. The arbitrary section 17.00 is used to add clarity to the organization of the material (43 pages).

TBG/edc
2-17-84

cc: Paul Mason, DCLS
Frank Lambert, DCLS
Regional Sanitarians, CHS
Joe Moschler, TES

Section 17.00

Sample Collection/Analyses

Section 17.00

Sample Collection/Analyses

17.01 GENERAL

The Waterworks Regulations require periodic monitoring of all public water supplies. It has been and will remain the responsibility of the waterworks owner to insure that the proper number of samples (bacteriological, physical, chemical, and radiological) are submitted for analysis. However, the Health Department will assist the owner, on a regular frequency in the collection of chemical and radiological samples. The Safe Drinking Water Act prescribes a frequency for the collection of samples for compliance determination. These frequencies are shown in Appendix 17A. For bacteriologicals the following will occur:

1. PWS's will receive from the appropriate state lab those number of bacteriological sample kits shown on MSIS. These numbers are to reflect the minimum required routine compliance samples.

2. Any extra containers required by the by the PWS will be supplied, if appropriate, by the Regional Office.

3. If your office receives laboratory service from two different laboratories, do not send improper sample containers or "return mailing labels" to a PWS.

4. The Regional Office will receive from the appropriate state laboratory(s) a regular monthly shipment of sample containers for any needed extra sampling. If this number is not sufficient, a written request to increase the number is to be addressed to the appropriate lab director from the Regional Office Director with a copy to BWSE's Laboratory Liaison - T.B. Gray.

17.02 SAMPLE PRIORITIES

The DCLS will analyze water samples from the Bureau on a priority basis. Some problems have been encountered in the past with an excessive number of unauthorized samples being received from Community Health Services and private citizens. In order to reduce this load on the DCLS, and thereby allow for faster turnaround of Bureau samples, DCLS has asked us to implement the following procedures:

A) Chemical/Radiation samples containers will be located at the Division of Water Program's regional offices.

B) DCLS will accept only these official containers.

C) The BWSE will distribute containers to others, if required, and therefore control the number of samples being taken.

D) At present, DCLS can process, with a two week turnabout, approximately 10 complete samples per week per Regional Office. More than this will result in backlogs and a longer turnabout time.

17.03 SAMPLE SCHEDULING

17.03.01 EXISTING SUPPLIES

It is necessary that each district determine the number of chemical/radiation samples that it must collect during a specified period of time (appendix 17A), then establish a tracking system so all monitoring samples are taken and so samples are spread out evenly over the monitoring period (of 1, 3, or 5 years). The milestones in this management must show:

1. When to sample
2. That an evenly spaced number of samples will be collected monthly
3. When sample was sent to the laboratory
4. When results were received
5. When letter was written to owner

These items are what is expected and what Technical Services will look for in regards to management of the program at the district level.

Please see Appendix 17B for sample log sheets that could be used or modified for this job duty. The use of these sheets is not mandatory, but maintenance of similar information is mandated. Form No. 1 is used to accomplish milestones 1 and 2. The use of the legend code in the month/ year column would indicate when a sample is to be taken; a circle around this code would indicate a job completed. Variations could be used to indicate a sample taken out of the scheduled sequence.

Form No. 2 is used to accomplish milestones 3 to 5; all columns are self-explanatory.

Remember to schedule this sampling so as to use the least amount of time and the lowest mileage possible.

Samples for trihalomethane analysis will be in accordance with a schedule provided by the BWSE central office. Bacteriological sampling will be either monthly (greater than 3 required per month) or Quarterly (less than 3 required per month).

17.03.02 NEW SUPPLIES

New supplies are those that have never been issued a permit by the Bureau. This includes newly "Found" supplies and those that are to be newly developed. New developed waterworks are to be sampled for compliance purposes after the operation permit has been issued. For newly "found" supplies, compliance samples are to be taken at the time of the sanitary survey and the operational permit can be issued prior to receiving sample results. For all new sources, development samples (radiation, inorganic and metals for groundwater sources plus organic and THM for surface sources) are to be

taken prior to issuing the construction permit; these are not compliance samples and use of DCLS is not mandated. For bacteriological development sampling a series of up to 20 samples may be needed. NOTE that all new community sources that must be sampled for four quarters to determine compliance will be issued a construction permit based on the first of four samples.

17.04 SAMPLING LOCATION

Generally all samples for compliance are collected at representative points within the distribution system. Two exceptions to this rule are listed below:

1. Turbidity - Regulations require the turbidity determination to be made at the point of entry to the distribution system.

2. Trihalomethane - Five distinct samples are required for each water source.

    (a) raw water (untreated, not used in determining compliance)
    (b) point representative of the distribution system
    (c) point representative of the distribution system
    (d) point representative of the distribution system
    (e) point of greatest water residence time in the distribution system.

Each of these points is to selected to test water from the specific source being sampled. All sampling points should be agreed to by the owner and the district engineer prior to sampling. The same designated sampling points should always be used each quarter. If possible, collect the samples on Wednesday of the designated week and get them into the lab within 48 hours. The samples do not have to be shipped with ice. If there is a need to change the sample schedule for some unforeseen reason or if sampling bottles have not been received, call Bob Potts at 786-4826. When the need arises to make a permanent change in the sampling schedule, submit a request to the lab with copies to Bob Potts and Mike Martin. Give the waterworks owner advance notice of the sampling to allow them to collect split samples for comparative analysis by their internal or contracted laboratory if they so desire. The letter shown in Appendix 17C is included with the vial package by DCLS and is shown for your information.

17.05 COLLECTION TECHNIQUES

It is an old axiom that the result of any test procedure can be no better than the sample on which it is performed. It is not possible to specify detailed procedures for the collection of all samples because of the varied purposes and analytical procedures. (See Appendix 17D for a summary of special sampling or handling requirements.) More detailed information can be obtained in connection with a specific parameter by contacting the laboratory. The objective of sampling is to collect a portion small enough in volume to be transported to and handled in

the laboratory conveniently while still accurately representing the system being sampled. This implies that the relative proportions or concentrations of all pertinent components will be the same in the samples as in the system being sampled, and that the sample will be handled in such a way that no significant changes in composition occur before the tests are made. Complete and unequivocal preservation of samples is a practical impossibility. Regardless of the nature of the sample, complete stability for every constituent can never be achieved. At best, preservation techniques can only retard the chemical and biological changes that inevitably continue after the sample is removed from the original source. The changes that take place in a sample are either chemical or biological. In the first case, certain changes occur in the chemical structure of the constituents that are a function of physical conditions. Metal cations may precipitate as hydroxides or form complexes with other constituents; cations or anions may change valence states under certain reducing or oxidizing conditions; other constituents may dissolve or volatilize with the passage of time. Metal cations may also absorb only glass or plastic surfaces, or be dissolved from the surface of the container. Biological changes taking place in a sample may change the valence of an element or a radical. Soluble constituents may be converted to organically bound materials in cell structures, or cell lysis may result in release of cellular material into solution. The well known nitrogen and phosphorus cycles are examples or biological influence on sample composition. Therefore, as a general rule, it is best to analyze the samples as soon as possible after collection. This is especially true when the analyze concentration is expected to be in the low ug/L range as it frequently is in drinking water. Methods of preservation are relatively limited and are intended generally to (1) retard biological action, (2) retard hydrolysis of chemical compounds and complexes, (3) reduce volatility of constituents, and (4) reduce absorption effects. Preservation methods are generally limited to pH control, chemical addition, refrigeration, and freezing.

GENERAL CONSIDERATIONS:

Obtain a sample that meets the requirements of the sampling program and handle it in such a way that it does not deteriorate or become contaminated before it reaches that laboratory.

Before filling, rinse sample bottle out two or three times with water being collected (except when the bottle contains a preservative as in the case of metals).

Sample carefully to insure that analytical results represent the actual sample composition. Important factors affecting results are the presence of suspended material and the physical and chemical changes brought about by storage or aeration.

Treat each sample individually with regard to the substances to be determined, the amount and nature of turbidity present, and other conditions that may influence the results.

Make a record of every sample collected and identify every bottle by attaching an appropriately inscribed tag or label. Record sufficient ....

information to provide sample identification at a later date. Each sample should be accompanied by an appropriate report form that has been filled out as completely as possible with the requested information.

Before collecting samples from distribution systems, flush lines sufficiently to insure that the sample is representative of the supply, taking into account the diameter and length of the pipe to be flushed and the velocity of flow. When studying distribution system problems, however, it is frequently advisable to sample both before and after flushing the system.

Collect samples from wells only after the well has been pumped sufficiently to insure that the sample represents the groundwater source.

Lakes and reservoirs are subject to considerable variations from normal causes such as seasonal stratification, rainfall, runoff, and wind. Choose location, depth, and frequency of sampling depending on local conditions and the purpose of the investigation.

Use only representative samples (or those conforming to a sampling program) for examination. The great variety of conditions under which collections must be made, makes it impossible to prescribe a fixed procedure. In general, take account both of the tests or analyses to be made and the purpose for which the results are needed.

17.05.01 DEVELOPMENT SAMPLING

A. Bacteriological Samples

The following special request procedures will be followed concerning the collection of bacteriological samples from proposed new groundwater sources or others of questionable nature:

1. If the health official cannot take the samples, the waterworks owner or operator will be instructed to collect at least 9 samples - preferably on Monday, Tuesday, or Wednesday - starting at least the second hour after starting the pump test and at a minimum spacing of one hour apart; the samples forms are to be marked by the health official - normally MPN in column 14-16. (See Appendix 17E) A supply of 20 sample bottles will be left with the owner.

   For Fecal Coliform determinations simply write in "Fecal" under Method as indicated. You should note that in this case the sample must arrive in the lab within 6 to 8 hours of the time of sample collection.

   In very <u>rare</u> cases the District Engineer may decide that a Fecal MPN analysis is necessary. This would be rare because normally, the confirmed presence of fecal coliform in <u>any</u> quantity is more than enough evidence to take immediate action. Remember that MPN determination ....

should not be requested unless it is specifically determined to be necessary. The MPN test requires a significant amount of extra work at the lab as well as an upset of the normal routine in the lab. When a Fecal MPN test is necessary, "Fecal MPN" should be written in under Method as indicated.

2. Immediately upon receipt of the sample results from all nine samples, the District Engineer will determine if additional samples for a mean MPN determination are necessary.

   If all portions of the 9 samples are negative, the source is determined to be satisfactory without chlorination. If any portion of the 9 samples is positive, the owner will be notified by the District Engineer to collect the 11 additional samples necessary for a mean MPN determination. If all dilutions are negative, no further special testing will be required.

3. If the geometric mean MPN of the 20 samples equals or exceeds 100, the source cannot be used with only chlorination for treatment.

4. If the geometric mean MPN of the 20 samples is greater than 3 but less than 100, then chlorination will be required.

5. If the sampling is terminated at the end of 9 samples, the additional 11 sample containers may be used by the owner to submit routine bacteriological samples if the sterile bottles are not tampered with and are used within a reasonable period of time.

17.05.01

B. Chemical Samples

1. Inorganic

   a) Non-Metal Analysis- one-half gallon plastic bottle. Temperature changes quickly; pH may change significantly in a matter of minutes; dissolved gases may be lost (oxygen, carbon dioxide). Determine temperature, pH, and dissolved gases in the field for accurate analysis results. With changes in the pH-alkalinity - carbon dioxide balance; calcium carbonate may precipitate and cause a decrease in the valves for calcium and for total hardness.

      Microbiological activity may be responsible for changes in the nitrate-nitrite-ammonia content, for decreases in phenol concentration and in BOD, or for reducing sulfate to sulfide. Residual chlorine is reduced to chloride. Sulfide, sulfite, ferrous iron, iodide, and cyanide may be lost through oxidation. Color, odor, and turbidity may increase, decrease, or change in quality. If glass collection containers are used; sodium, silica and boron may be leached out of the glass container.

      In general, the shorter the time that elapses between collection of a sample and its analysis, the more reliable will be ....

the analytical results. For certain constituents and physical values, such as pH, CO_2, alkalinity, turbidity and color, immediate analysis in the field is required.

It is impossible to state exactly how much elapsed time may be allowed between sample collection and its analysis; this depends on the character of the sample, the analysis to be made, and the conditions of storage. Changes caused by growth of microorganisms are greatly retarded by keeping the sample in the dark and at a low temperature. When the interval between sample collection and analysis is long enough to produce changes in either the concentration or the physical state of the constituent to be measured, follow the preservation practices given in the sample preservation table in the appendix. When the final report is interpreted the elapsed time between sampling and analysis, and which preservative, if any, was added should be taken into consideration when interpreting the results.

Storage at low temperature (4❍C) is perhaps the best way to preserve most samples for short periods of time. The non-metal samples should be shipped to the laboratory as soon as possible after collection and kept refrigerated when possible.

Monthly fluoride split sample bottles are mailed to the waterworks by DCLS. Send a memo to Bob Potts to include PWS on the mailing list.

b) Metal Analysis - 210 ml plastic bottle containing nitric acid for sample preservation. This bottle contains the proper amount of acid to attain an acid concentration of 0.5% when the bottle is filled to the top. These bottles are prepared by DCLS and a quality control check is made on random bottles to assure the absence of initial contamination. Some determinations are more likely than others to be affected by sample storage before analysis are. Certain cations are subject to loss by absorption on the walls of the container. These include aluminum, cadmium, chromium, iron, lead, manganese, silver and zinc, which are best collected in a bottle acidified with nitric acid to a pH below 2.0 to minimize precipitation and absorption on container walls. Properly preserved samples for metals analyses can be held for 6 months except for mercury which must be analyzed by 13 days following collection. It should be noted that postal regulations prohibit the mailing of empty bottles containing any minute amount of concentrated acid through the mail. Also DOT Regulations prohibit shipping by common carrier unless in specified containers and warning labels.

2. Organics

a) Insecticides and Herbicides - Samples should be sufficiently iced in a cooler as soon as possible after collection to ....

maintain a temperature of 4❍C and shipped to the laboratory within 48 hours of collection. The maximum holding time for chlorinated hydrocarbons (insecticides) is 14 days and the maximum holding time for chlorophenoxys (herbicides) is 7 days. These sampling requirements are especially important for the Safe Drinking Water Act compliance samples as they are specified in the Federal Register and samples not complying should be rejected by the laboratory. When submitting samples to the laboratory for suspected pesticide contamination, it is vital to send as much information as can possibly be obtained with the sample. There are a great number of pesticides on the market and the request for "pesticide analysis" is totally inadequate. It is a good possibility that the test run in the laboratory will not detect the pesticide in the sample if we have no idea what we are looking for.

Sampling from a water tab: Turn on water and allow system to flush. When the temperature is stabilized, adjust the flow to about one liter per minute. Fill the bottle about 90% full and seal.

Samples should be collected in clean 1 liter (quart) glass containers with aluminum foil between the sample and the cap. For both insecticide and herbicide analyses send three(3) 1-quart samples (1 for herbicide, 1 for insecticide, and 1 for quality control and breakage protection). If sampling for only insecticide or herbicide submit two(2) 1-quart samples. Bottles that have contained materials such as mayonnaise, coke, juice, pickles, etc. are not acceptable for samples. No plastic or other types of organic material should be used for sampling or come into contact with the sample.

b) Trihalomethane - A sample is to be taken in a 40-ml vial in such a manner that it is not aerated. These vials are furnished by DCLS. They are marked either "Untreated" or "S_2O_3= ." The untreated vials are for raw water samples. The vials marked "S_2O_3= " contain 2-3 mg of sodium thiosulfate which removes residual chlorine, thereby inhibiting further THM formation. DO NOT RINSE THESE VIALS. DO NOT AERATE THE SAMPLE WHEN FILLING THE VIAL. To start sample collection, remove the cap liner (septum) from the cap. The vial is to be overfilled so that a convex meniscus forms. When the vial has been filled, slide the cap line (septum) with the red teflon side toward the sample and then cap and tighten. THE RED SIDE OF THE LINER MUST BE IN CONTACT WITH THE SAMPLE. Invert the vial and tap the sides to examine for air bubbles. THERE MUST BE NO AIR BUBBLES IN THE SAMPLE. If air is present, remove the cap and add more sample and repeat the above procedure.

Sampling from a faucet: Remove the faucet aerator, if present. Adjust the water flow for a slow, gentle stream (about 500 ml/min.) and wait until equilibrium has been obtained (3-5 minutes). Hold the vial under the flowing stream close ....

to the faucet in such a manner that the water runs down the side of the vial while filling. Then cap as directed above.

Sampling from an open body of water: Fill by submerging a 1 quart or larger clean glass bottle. The 40-ml sample vial may then be filled from the sample taken in the bottle.

THE SAMPLES SHOULD THEN BE DELIVERED WITHIN 48 HOURS TO DCLS AND ARE NOT REQUIRED TO BE ICED. IT IS PREFERRED THAT THE SAMPLES BE COLLECTED ON A WEDNESDAY OF THE SAMPLING WEEK TO BE RECEIVED BY THE LAB BY FRIDAY.

c) Petroleum Type Contaminants - The sampling requirements for petroleum contaminants is almost the same as for pesticides.A ½ gallon sample is required for this analysis. It would be possible to use two(2) 1-quart samples if a ½ gallon container is not available. As in the case of pesticides, the bottle must be clean and aluminum foil should be placed between the sample lid and the sample. Fill the sample bottles completely, leaving as little air space as possible. THE SAMPLE SHOULD BE SHIPPED ON ICE if possible to prevent further deterioration of the organic contaminant. Send as much information about the sample as possible to the laboratory with the sample.

d) All other organics (Volatile/Extractable Organics; Taste & Odor Problems): Other types of organic contaminants not mentioned above should be collected in 1 gallon amber glass bottles with aluminum foil or teflon cap liners. These bottles should be kept at each regional water supply office in case of an emergency situation. In an emergency situation where a bottle is needed and not available, a clear bottle can be used and covered completely with aluminum foil to prevent sample deterioration. Fill the sample bottles completely leaving as little air space as possible to prevent possible oxidation of the organic contaminant. These samples should be sufficiently iced in a cooler as soon as possible after collection to maintain a temperature of 4❍C and shipped to the laboratory within 48 hours of collection.

17.05.01

C. Radiation Samples

For the routine gross alpha analysis, a ½ gallon sample is required. This is also sufficient sample for running gross beta, for supplies with populations over 100,000. Preservation in the field is not required as the samples can be acid preserved after receipt at DCLS. As an initial part of the gross alpha analysis, the laboratory determines the specific conductance of the sample. If the sample is acidified in the field, this is not possible. When the sample is shipped to a laboratory or storage area, acidification of the sample (in its original container) may be delayed for a ....

period not to exceed 5 days. Most systems will submit radiological samples on a quarterly basis with compliance based on the average of 4 consecutive quarter's results. However, if previous quarterly samples establish the activity level to be less than one-half the PMCL, a single grab sample may be substituted for future quarterly sampling (WW Regulations 4.07a.2).

The Waterworks Regulations require that when the gross alpha count exceeds five picocuries per liter, radium analysis must be made. If the Division of Water Programs' field staff feels or knows that it is necessary to perform the radium analysis, regardless of whether the gross alpha exceeds five picocuries, such samples need to be adequately identified on the laboratory report form which is sent to DCLS with the sample. These requests should be held to a minimum as the cost for these analysis is significant and resources are limited. The laboratory report form should indicate that radium analyses are required, when possible. When the Water Programs' field staff request testing for radium or radium and uranium, it is necessary that two ½ gallon or a one gallon sample be collected and sent to the lab. The additional sample is required for the additional tests and quality control purposes.

17.05.02 COMPLIANCE SAMPLING

A. Bacteriological - follow the booklet "Bacteriological Sampling of Public Works Supplies."
B. Chemical - same as 17.05.01B
C. Radiation - same as 17.05.01C

17.05.03 CHECK SAMPLES

A. Bacteriological Samples - follow booklet "Bacteriological Sampling of Public Water Supplies"
B. Chemical Samples

1. Inorganic

a) Nonmetal - Fluoride and Nitrate: For fluoride and nitrate check samples, the 6 oz bottle used for fluoride testing should be used. This bottle is provided by DCLS and comes with a cardboard mailing container, a preaddressed mailing label and a form for fluoride analysis. When using this kit for check samples, remove the regular fluoride form and substitute the chemical form regularly used for samples. Other nonmetals: use the regular ½ gallon plastic bottle. Most other nonmetal tests require more than 6 oz of sample.

b) Metals - use the same procedure for collecting samples

for metals analyses as outlined in 17.05.01B. 1(b). For quality control purposes collect the metals check samples IN DUPLICATE taken simultaneously.

2. Organic

Use the same procedure for collecting samples for organic contaminants as outlined in 17.05.01B. 2(a, b, c & d).

C. Radioactivity Samples

There is no requirement for check samples for radiological results. The determination of compliance is based on quarterly samples; therefore, if a high result is obtained in one quarter it is merely used when the total four quarters of samples have been collected and the results are then averaged to determine compliance.

17.05.04 REPETITIVE SAMPLING

When sampling is to be repetitive for compliance determination (radionuclides, trihalomethanes, fluoride), the Division Engineer should be on-site and either directly collect or assist in the collection of the initial sample. The procedure, timing, and special sampling precautions should be given to the owner at that time. Subsequent quarterly sampling is the responsibility of the waterworks owner.

Only under special situations should a Division Engineer be present for each quarterly sample.

17.06 SAMPLE CONTAINERS

17.06.01 COMMUNITY SUPPLIES

A. Surface Water Samples

1. ½ gallon plastic; nonmetals
2. 6 oz plastic; metals
3. 3 1-quart glass; insecticides and herbicides
4. ½ gallon plastic; radioactivity - If you have a supply that you know is going to need an analysis for radium send 2 ½ gallon plastic containers.
5. glass bottle or plastic Whirlpak (4 ounce = 100 ml); bacteriological

B. Groundwater Samples

1. ½ gallon plastic; nonmetals
2. 6 oz plastic; metals
3. ½ gallon plastic; radioactivity - If you have a supply that you know is going to need an analysis for radium send 2 ½ gallon plastic containers

4. glass bottle or plastic Whirlpak; (4 ounce = 100 ml); bacteriological

17.06.02 NONCOMMUNITY SUPPLIES

A. Surface Water Samples

1. ½ gallon plastic; nonmetals
2. 6 oz plastic; metals
3. glass bottle or plastic Whirlpak; (4 ounce = 100 ml); bacteriological

B. Groundwater Samples

Same as 17.06.02A.

17.07 SAMPLE FORMS

To insure samples are identified and handled properly, certain forms must accompany the sample containers.

17.07.01 Bacteriological - Reference booklet "Bacteriological Sampling of Public Water Supplies."

17.07.02 Chemical/Radiation - Reference Appendix 17F for forms and instructions.

17.08 NORMAL SAMPLE ANALYSIS

It is expected that certain normal analyses will be performed by DCLS. (See Appendix 17G). Note that turbidity sampling will be done onsite by the owner where required and/or by the Bureau. The DCLS results of turbidity are not entirely accurate due to the oxidation time that elapses between sampling and analysis; therefore, expedite shipment to the lab.

The approved test for turbidity (nephelometric) is a time-dependent test. The 13th edition of Standard Methods states, "Turbidity should preferably be determined on the same day as the sample is taken. If longer storage is unavoidable, however, samples may be stored in the dark up to 24 hours ... Prolonged storage before measurement is not recommended, as irreversible changes in turbidity may occur." The 14th edition (p. 132) is even more forceful regarding time period for analysis.

Because of this time restriction, we must be careful not to determine noncompliance based on samples that were not analyzed in accordance with standard methods.

The results received from DCLS may be used to define systems that need further study and this would be an ideal application for the portable turbidimeter that had been provided to each regional office.

Also note that there is an alternative calibration suspension to formazin. This new polymer (nephelometric/styrene Divinyl benzene polymer) has an extended shelf life and may be suitable for use with our turbidimeters.

If you have any special sampling, it will be determined on a case-by-case basis.

17.09 APPROVED LABORATORIES

a. Certified Labs

Appendix 22A-3 in the Inventory/Data Handling Working Memo lists all laboratories certified for compliance sampling through MSIS. These labs are municipally/governmentally owned. A majority of the laboratories run multiple bacteriological samples which are submitted to BWSE on a Summary Report form.

Appendix 17H - shows the labs that are listed with the Division of Consolidated Laboratory Services (DCLS). (Note: Appendix 17H adds commercial labs to the list of Appendix 22A-3). For development samples any of these Appendix 17H laboratory's sample analysis results can be accepted as a basis for issuance of a construction permit, i.e., use of DCLS is not mandatory by the owner.

b. Laboratory Boundaries for Sample Submission

Appendix 22A-5 - indicates the Planning Districts/Counties that will generally be served by the listed State (DCLS) laboratories for those waterworks not reporting summary data. All compliance chemical and radiological testing is authorized only at DCLS-Richmond.

c. Lab Certification

As the State Lab (DCLS-Richmond) has been given the responsibility by DWP - BWSE for certifying labs for the SDWA, the DWP - BWSE must work closely with the lab's Water Quality Assurance Section (Mr. Warner Braxton 786-3411). This section receives the applications from the labs desiring certification. Therefore, when we receive plans for a new lab, we will seek the advice of WQAS to determine if the laboratory equipment is satisfactory for certification. To do this, a copy of the equipment listing will be mailed to Mr. Braxton who will, via memorandum, advise us as to what conditions must be met for certification.

Also WQAS will be notifying DWP - BWSE (Mr. Allen Hammer) via memo of new certified labs or decertification action so we may update Appendix 17H - 1 in the MSIS Lab Table.

Mr. Braxton has agreed to notify each DWP Regional Office in advance of a laboratory onsite inspection. This will enable DWP - BWSE staff to accompany the inspection team in order to learn the certification require- ....

ments. DWP - BWSE staff on routine sanitary surveys will then be able to give better advice to the waterworks laboratory and provide feedback to DCLS. Also as was past practiced, Mr. Braxton will provide the Bureau with a copy of each lab report. He is to forward this report directly to each of our Regional Offices; ATTN: Regional Director.

17.10 DISTRIBUTION OF RESULTS

17.10.01 BACTERIOLOGICAL

All bacteriological results will be routed by the State Laboratories back to the appropriate health official. Appendix 17K indicates the flow stream for result handling by each lab. On all "unsatisfactory samples," the health official's office will be called so the health official may contact the PWS owner to expedite resampling. ("Unsatisfactory samples" are those with single positives or MPN of 2 or more, TNTC, leaked in transit, or lab accident). As a permanent office record, the results will be recorded in the form in Appendix 17I.

17.10.02 CHEMICAL SAMPLES

All sample results public or private will be mailed to Division of Water Programs Regional Office by DCLS. The results will be packaged according to planning district for easy interoffice distribution. Those results not dealing with community waterworks should be "buckslipped" by the district engineer to the appropriate health officials (CHS, TES, or Shellfish). The District Engineer will insure that the waterworks owner is notified in writing of the results of the sample analysis. This notification will include the following: (1) highlight of items exceeding MCL, if any and; (2) statement on aggressiveness of water. If the sodium content exceeds 20 ppm, the appropriate District Health Officer with Community Health Services must be notified via copy of the letter so that local physicians will be made aware of sodium content.

17.10.03 RADIATION

Same as 17.10.02

Appendix 17

Appendix 17A

Monitoring Frequency for Waterworks

Contaminant	Waterworks Source	Sampling Frequency	
		Comm	Noncomm
Coliform	Ground and Surface	Monthly	Quarterly
Chlorine Substitution	Ground and Surface	Daily	Daily
Inorganic Chemicals	Ground	3 years	5 years (Nitrate only
	Surface	1 year	1 year
Organic Chemicals	Ground	N.R.*	N.R.*
	Surface	1 year	1 year
Turbidity	Ground	N.R.*	N.R.*
	Surface	Daily	Daily
Radioanalysis Gross Alpha Gross Beta	Ground and Surface	3 years❍	N.R.*
	Ground	N.R.*	N.R.*
	Surface	3 years+❍	N.R.*
Trihalomethanes**	Ground and Surface	Quarterly++	N.R.*

*N.R. - indicates nonroutine - if problems with these contaminants are identified, the Bureau may prescribe a PMCL and a monitoring frequency.

** - Applicable only to systems which disinfect; effective dates: Population greater than 75,000 - November 29, 1981; population 10,000-75,000 November 29, 1983.

\+ - For system serving populations greater than 100,000 persons.

++ - Compliance based on a running annual average.

❍ - Previous 4 year frequency changed to coincide with other 3 year frequencies

EXAMPLE OF THE SAMPLE TRACKING FORM #1

EXAMPLE OF THE SAMPLE TRACKING FORM #2

(PRINTED ON VDH LETTERHEAD)

September 8, 1983

THM SAMPLING PROCEDURE

Trihalomethane (THM) Sampling - The following technique should be used:

A sample is to be taken in a 40 ml vial in such a manner that it is not aerated. These vials are furnished by DCLS. They are marked either "Untreated" or "S_2O_3=." The untreated vials are for raw water samples or for samples to be tested for maximum THM potential. The vials marked "S_2O_3=" contain 2-3 mg of sodium thiosulfate which removes residual chlorine, thereby inhibiting further THM formation. DO NOT RINSE THESE VIALS. DO NOT AERATE THE SAMPLE WHEN FILLING THE VIAL. To start sample collection, remove the cap liner (septum) from the cap. The vial is to be overfilled so that a convex meniscus forms. When the vial has been filled, slide the cap liner (septum) with the red teflon side toward the sample and then cap and tighten. Invert the vial and tap the sides to examine for air bubbles, THERE MUST BE NO AIR BUBBLES IN THE SAMPLE. If air is present, remove the cap and add more sample and repeat the above procedure.

Sampling from a faucet: Remove the faucet aerator, if present. Adjust the water flow for a slow, gentle stream (about 500 ml/min.) and wait until equilibrium has been obtained (3-5 minutes). Hold the vial under the flowing stream close to the faucet in such a manner that the water runs down the side of the vial while filling. Then cap as directed above.

Sampling from an open body of water: Fill by submerging a 1 quart or larger clean glass bottle. The 40 ml sample vial may then be filled from the sample taken in the bottle.

The samples should then be delivered within 48 hours to DCLS and are not required to be iced. It is preferred that the samples be collected on a Wednesday of the sampling week to be received by the lab by Friday.

Send samples and completed forms to: Div. of Consolidated Laboratory Services
Bureau of Environmental Science
Potable Water Section, Room 318
1 North 14th Street
Richmond, Virginia 23219

TABLE 105:1 SUMMARY OF SPECIAL SAMPLING OR HANDLING REQUIREMENTS
(Reproduced from a book)

TABLE IV-2 - SAMPLE COLLECTING, HANDLING, AND PRESERVATION
(Reproduced from a book)

EXAMPLES OF BACTERIOLOGICAL OR TURBIDITY ANALYSIS INPUT FORMS

revision 11-14-83

CHEM/RAD SAMPLE REQUEST FORMS

In order for samples to be identified from field sampling, each sample container will be tagged with the below shown tag. This tag/container will be accompanied to DCLS by the appropriate analysis report form shown below. Be sure that both tag and form are filled in legibly and accurately. DCLS will perform the desired analysis, fill in the remaining portions of the form and send copies to the appropriate Regional Office and BWSE-HQ. BWSE-HQ will have its copy entered into the computer. Regions still must send a copy to BWSE-HQ files along with their transmittal letter to the waterworks owner.

(Example of the tag is taped to page)

FLOW SCHEME OF CHEMICAL-RADIOLOGICAL FORMS (WSE 50)

Compliance -Administrative responsibility of health dept.
Sampling -Process to DCLS

New Chem/ Rad Forms WSE 50 -Enter field data and send to DCLS along with tagged sample container

Analysis By DCLS

BWSE Central MSIS Manager

Regional Office

Key Punch

Original to File

Copy to Owner

Standard Update Statistics Report

Reports Produced By Special Request

Revised 11-15-83

INSTRUCTIONS FOR PUBLIC CHEMICAL-RADIOLOGICAL SAMPLE INPUT FORMS (WSE 50)

*HEALTH OFFICIAL COMPLETES THESE FIELDS WITH BLACK INK PEN

1. LAB # - Lab number which identifies each sample - assigned by DCLS

*2. NAME OF WATER SYSTEM - Enter identifying name of waterworks.

*3. SOURCE - Indicate the source of water (well #, spring #, surface supply name).

*4. OTHER INFORMATION - Add any other information that may be useful.

*5. REPORT RESULTS TO HEALTH OFFICIAL AT - Print or type complete address of health department official to whom results are to be sent. Engineering Region need only check appropriate region in item 6 below.

*6. REGION - Check appropriate DWP region or CHS local health. If neither, check blank and write in your health dept. bureau name.

*7. PLANNING DISTRICT # - Enter the planning district number where the PWS is located.

*8. COUNTY - Enter the name of the county where the PWS is located.

*9. INDEPENDENT CITY - Enter the city where the PWS is located.

*10. SAMPLING LOCATION - Enter a word description of the sampling point. This is most useful when multiple samples are taken from the same distribution system.

*11. CODE - Enter the unique location code being assigned to each unique sample location.

*12. SOURCE TYPE - Check appropriate plant type.

*13. FIELD TESTS - Enter results of field test performed.

*14. PWS ID # - Enter the unique waterworks identifying number.

*15. DATE COLLECTED - Enter the date on which the sample was collected.

16. CONT. ID - Preprinted unique contaminant identifying number.

17. CONTAMINANT NAME - Preprinted name of the contaminant.

18. MTD - Preprinted analysis method code.

19. S. - Sign, less than (<), greater than (>), positive (+), negative (-) - entered by DCLS

20. ANALYSIS RESULTS - Entered by DCLS, expressed in mg/L or pCi/L as indicated.

21. PRECISION - Entered by the DCLS. A positive integer stipulating that the analysis result is to be expressed as a range - only valid for radiological results.

22. ANALYSIS DATE - The date in which the analysis was performed, DCLS completes this field.

23. A* - Analyst's initials who performed the tests - DCLS.

*24. TIME - Enter the time in which the sample was collected.

*25. COLLECTED BY - Enter the name of the person collecting the sample. PRINT CLEARLY!!

*26. CONTAINER TYPE - Check the type of container used.

*27. PRESERVATIVE USED - Check the type of preservative used.

*28. SAMPLE TYPE - Check the appropriate sample type.

29. DATE REC - Date received by DCLS
DATE REP - Date reported by DCLS

30. PREPARED BY - Name of chemist who prepares the report - DCLS

31. LAB ID - Preprinted identifying code of laboratory.

EXAMPLE OF CHEM/RAD REQUEST FORM

BLANK WATER QUALITY REPORT SHOWING ALL AREAS TO BE FILLED OUT BY HEALTH OFFICIAL)

EXAMPLE OF CHEM/RAD REQUEST FORM
INORGANIC WATER QUALITY REPORT

EXAMPLE OF CHEM/RAD REQUEST FORM
METALS WATER QUALITY REPORT

EXAMPLE OF CHEM/RAD REQUEST FORM
PESTICIDE WATER QUALITY REPORT

EXAMPLE OF CHEM/RAD REQUEST FORM
RADIOLOGICAL WATER QUALITY REPORT

EXAMPLE OF CHEM/RAD REQUEST FORM
TRIHALOMETHANE WATER QUALITY REPORT

EXAMPLE OF CHEM/RAD REQUEST FORM
BLANK WATER QUALITY REPORT

BLANK LABORATORY REPORT FROM:

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF GENERAL SERVICES
DIVISION OF CONSOLIDATED LABORATORIES
BUREAU OF ENVIRONMENTAL SCIENCE

Community	Noncommunity
Arsenic	Initial noncommunity sample will
Barium	be the same as for a community
Cadmium	sample for the inorganic
Chromium	parameters and for surface
Lead	supply organic chemicals.
Mercury	
Selenium	Subsequent routine sampling will
Silver	include Nitrate/Nitrogen only.
Aluminum	
Calcium	
Iron	
Magnesium	
Manganese	
Strontium	
Zinc	
Copper	
Potassium	
Sodium	
Nickel	
Boron	
Calcium Hardness	
Magnesium Hardness	
Ca & Mg Hardness	
Total Hardness	
(Al, Ca, Fe, Mg, Mn, Sr &Zn)	
pH	
Alkalinity	
Total	
Bicarbonate	
Carbonate	
Hardness - EDTA	
Acidity	
Corrosive (Aggressive) Index	
Fluoride	
Chloride	
Color (APHA)	
Turbidity (FTU)	
Hydrogen Sulfide	
Sulfate	
Nitrate/Nitrogen	
Nitrate/Nitrogen	
Ammonia/Nitrogen	
Total Kjeldahl/Nitrogen	
Phosphate/Total as P	
Phosphate/Ortho as P	
Specific Conductance	
Total Dissolved Solids	
Volatile	
Fixed	
Silica	

Community	Noncommunity
Chlorophenoxy Acid Type Herbicides	
Chlorinated Hydrocarbon Type Insecticides Specifically Endrin, Lindane, Methoxychlor, and Toxaphene	
Radioactivity Gross alpha Gross beta (populations over 100,000) Radium 226 (when indicated) Radium 228 (when indicated) Uranium (when indicated)	
Trihalomethanes (Populations over 10,000)	

Commonwealth of Virginia
Department of General Services
Division of Consolidated Laboratories
Safe Drinking Water Program
Microbiological and Chemical Certifications

ID	NAME	CITY	ZIP	CER/DATE	MIC	As Ba Cd Cr Pb Hg Se Ag F NO_3	END LIN MET TOX 24D 245T	THM
	Fairfax Co. Health Dept.	Fairfax	22030	82-08-01	C			
	Dewberry & Davis	Fairfax	22031	81-07-26	C	C C C C C C NC C C C		
	Fairfax Co. Water Authority	Herndon	22072	83-03-01	C	C C		C
	Manassas City Water Dept.	Manassas	22110	82-11-01	C			
	Fairfax Co. Water Authority	Occoquan	22125	83-10-01	C	C C C C C C C C C C		
	Versar, Inc.	Springfield	22151	81-02-05	PC	C C C C C C C C C C	C C C C C C	C
	Hazelton Lab. America,Inc.*	Vienna	22180	81-04-13	C			
	VDACS	Warrenton	22186	83-10-01	C			
	Occoquan-W'Bridge-Dumfries	Woodbridge	22194	81-07-01	C			
	Virginia American Water Co.	Alexandria	22313	83-09-01	C			
	Clifford,G.W. & Associates	Fredricksburg	22401	83-09-01	C			
	Shellfish Sanitation (VDOH)	Whitestone	22578	81-03-18	C			
	Winchester Wtr. Treatment Pl.	Middletown	22645	83-10-01	C			
	ESS Laboratories	Culpeper	22701	82-03-01	C	C C C C C C C C C C		
	VDACS	Harrisonburg	22801	82-06-01	C			

	Harrisonburg Water Tr. Pl.	Harrisonburg	22801	82-06-01	C			
	DCLS-Shenan. Regional Lab	Luray	22835	83-11-01	C			
	Rivanna Water Treatment Plant	Charlottesville	22902	82-06-01	C			

C - CERTIFIED
PC - PROVISIONALLY CERTIFIED
NC - NOT CERTIFIED

Commonwealth of Virginia
Department of General Services
Division of Consolidated Laboratories
Safe Drinking Water Program
Microbiological and Chemical Certifications

ID	NAME	CITY	ZIP	CER/DATE	MIC	As Ba Cd Cr Pb Hg Se Ag F NO_3	END LIN MET TOX 24D 245T	THM
	Aqua Air Laboratories,Inc.	Charlottesville	22903	81-05-13	PC	C C C C C C C C C C	C C C C C C	
	Hanover Dept.Pub. Utilities	Hanover	23069	82-09-01	C			
	Chesterfield Co. Utility Sec.	Midlothian	23113	82-06-01	C			
	Richmond Purification Plant	Richmond	23221	83-08-01	C			
	Henrico Co. Public Utilities	Richmond	23223	83-07-01	C	C C C C C C C C C C		
	Commonwealth Lab Inc.	Richmond	23223	83-09-30	NC	C C C C C C NC C C C	C C C C C C	C
	Froehling & Robertson, Inc.	Richmond	23228	83-03-01	NC	C C C C C C C C C C		
	Richmond City Health Dept.	Richmond	23240	82-12-01	C			
	Analytics Laboratory	Richmond	23260	81-02-13	C	C C C C C C C C C C	C C C C C C	C
	Tecsult Labs	Richmond	23288	83-05-01	NC	C C C C C C C C C C	NC NC NC NC NC NC	C
	Shellfish Sanitation (VDOH)	Accomac	23301	81-06-25	C			
	Chesapeake Public Utilities	Chesapeake	23320	82-09-01	C			
	Suffolk, City of	Suffolk	23434	83-05-01	C			
	Jennings Laboratories,Inc.	Virginia Beach	23451	83-05-01	C	C C C C C C C C C C	NC NC NC NC C NC	
	Hampton Roads Sanitation	Virginia Beach	23455	81-12-01	C	C C C C C C C C C C	District S. Shore	

	Va. Beach Wat. Test. Lab	Virginia Beach	23456	82-09-01	C			
	Norfolk-37th St. Filter Plant	Norfolk	23502	82-08-01	C			
	Norfolk-Moore's Bridge	Norfolk	23502	82-08-01	C			C

Commonwealth of Virginia
Department of General Services
Division of Consolidated Laboratories
Safe Drinking Water Program
Microbiological and Chemical Certifications

ID	NAME	CITY	ZIP	CER/DATE	MIC	As Ba Cd Cr Pb Hg Se Ag F NO_3	END LIN MET TOX 24D 245T	THM
	Shellfish Sanitation (VDOH)	Norfolk	23507	83-04-01	C			
	US Navy Navy Environ.and Preventive Med. Unit #2	Norfolk	23511	83-04-01	C			
	US Navy Navy Environ. and Preventive Naval Station	Norfolk	23511	81-02-20	C			
	Newport News Public Utilities	Newport News	23602	82-07-01	C			
	Hampton Roads Sanitation District N. Shore	Newport News	23602	83-07-26	C	C C C C C C C C C C	C C C C C C	
	Reed, James R.& Assoc.,Inc	Newport News	23606	81-06-08	C	C C C C C C C PC C C		C
	US Army Big Bethel WTP	Ft. Monroe	23651	82-08-01	C			
	Bionetics Corporation	Hampton	23666	83-10-01	C			
	Portsmouth Public Utilities	Portsmouth	23705	82-10-01	C			
	Norfolk Naval Shipyard	Portsmouth	23709	83-10-01	C			
	US Army Medical Dept. Act.	Ft. Lee	23801	82-10-01	C			
	Appomattox Riv. Wat. Auth.	Petersburg	23803	82-09-01	C			
	Virginia American Water Co.	Hopewell	23860	83-09-01	C			

	VDACS	Ivor	23866	82-06-01	C			
	Farmville WTP	Farmville	23901	83-06-01	C			
	B & B Laboratory	Chase City	23924	82-07-01	C	C C		
	Carvins Cove Fltr. Pl.	Roanoke	24009	83-08-01	C			
	Norfolk-Moore's Bridge	Norfolk	23502	82-08-01	C			

Commonwealth of Virginia
Department of General Services
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ID	NAME	CITY	ZIP	CER/DATE	MIC	As Ba Cd Cr Pb Hg Se Ag F NO_3	END LIN MET TOX 24D 245T	THM
	Black-C'Burg-VPI Water Auth.	Blacksburg	24060	83-08-01	C			
	Olver, Inc.	Blacksburg	24060	83-09-01	PC	C C NC C NC C NC NC C C		
	US Army-Radford Ammunition Plant	Radford	24141	81-02-20	C			
	Radford Water Treatment Pl.	Radford	24141	83-07-01	C			
	Martinsville Purification Pl.	Ridgeway	24148	83-10-11	C			
	Centec Analytical Services	Salem	24153	83-04-01	NC	NC NC NC NC NC NC NC NC NC NC	C C C C C C	
	Salem Water Dept.	Salem	24153	83-08-01	C			
	Bristol Va. Utilities Board	Bristol	24201	83-06-01	C			
	DCLS-S'West Regional Lab.	Abingdon	24210	83-06-01	C			
	Washington Co. Service Auth.	Abingdon	24210	81-02-19	C			
	Pulaski Filter Plant	Pulaski	24301	81-04-17	C			
	Pulaski County Water Tr. Pl.	Pulaski	24301	83-07-01	C			
	VDACS	Wytheville	24382	83-07-01	C			
	VDACS	Lynchburg	24502	83-10-01	C			
	Lynchburg-Utilities Division	Lynchburg	24505	83-10-01	C			

	Danville City Water Plant	Danville	24541	83-08-01	C			
	South Boston Filter Plant	South Boston	24592	83-05-01	c			

BACTERIOLOGICAL ANALYSES

County _____ Waterworks _____

Type of Treatment _____ Owner _____

Source _____ Samples Required ___per (month) (quarter)

Date Col.	Sample Location	By	Cl_2 Res.	MPN	Number of positive (+) tubes	Lab Number

APPENDIX 17J

HANDLING OF BACTERIOLOGICAL RESULTS

MSIS

Preprinted Forms

Laboratories --- Match forms to containers. If containers are returned to lab because undeliverable (wrong address, out of business, etc.) the lab will send a memo to the appropriate health official indicating the MSIS must be changed.

PWS --- Take samples on assigned frequency during compliance period.

Appropriate State Lab --- Daily, after results are finalized, lab retains the back copy and will mail/deliver 3 copies of the results as shown below. For labs not located adjacent to health officials' office, all unsatisfactory samples" will be called to the health official. "Unsatisfactory samples" are those with single positives or MPN of 2 or more, TNTD, leaked in transit , or lab accident.

DCLS-Southwest		Fairfax Health Lab		DCLS-Shenandoah		DCLS-Richmond	Shellfish-Accomac	
Community	NC	Community	NC	Comm.	NC	C & NC	Comm	NC
deliver to Abingdon Engineering office	A.CHS deliver to R.S.	mail/call to Culpeper Engineers	A.CHS deliver to R.S.	mail/call Lexing-ton or Culpeper	A.CHS mail/ call to super-visory Sanit-arians	deliver to BWSE-HQ who will contact appropriate health official	mail/ call VA Beach Engi-neers	A.CHS deliver to Sup. San.
	B.TES deliver to Region 1 mail/ call Region 2		B.TES mail/ call to Region 6		B.TES mail/ call Regions 2,5,6, & 12			B.TES mail/call to Region 3
	C.SS None		C. SS None		C. SS None			C. SS Retain

Health Official --receives 3 copies of result form/call from lab or BWSE-HQ; ALL CALLS WILL BE RELAYED TO PWS FOR RESAMPLING. Result forms must be checked for unsatisfactories and cross checked with previous calls; and relay unsatisfactories to PWS if necessary. All results will be entered by the health office onto the Bacti Log sheet for that PWS. The original copy of the result form will be mailed quickly to the PWS; the 2nd copy is for health official use; and the 3rd copy (extra since there is no input into the computer) can and should be shared with any other health official (i.e. CHS/TES at restaurant-motel complex).

NOTE: ENGINEERS - For State Parks, the original copy is to be mailed, not to the particular park, but to: Commissioner, Division of Parks, 1201 Washington Bldg, Capital Square, Richmond, Virginia 23219.